EPA's Review of Water Quality Criteria for Phosphorus in Rivers and Lakes in Wisconsin under Section 303(c) of the Clean Water Act (CWA) WQSTS WI2010-380

Date: DEC 30 2010

I. Summary

A. Date received by EPA

Request for approval letter: December 14, 2010
Attorney General Certification: December 29, 2010

B. Submittal History

On December 29, 2010, EPA received the complete package of final phosphorus water quality standards from Wisconsin Department of Natural Resources (WDNR) for rivers and lakes in Wisconsin, including the portions of Lake Michigan and Lake Superior that are part of Wisconsin, for approval under the CWA section 303(c).

C. Documents included in the submittal:

- Technical Support Document for Wisconsin Phosphorus Water Quality Standards
- Robertson, D.M., B.M Weigel, and D.J. Graczyk, 2008, Nutrient Concentrations and their relations to the biotic integrity of nonwadeable rivers in Wisconsin: U.S. Geological Survey Professional Paper 1754, 81 p.
- Robertson, D.J. Graczyk, P.J. Garrison, L. Wang, G. LaLiberte, and R. Bannerman, 2006, Nutrient Concentrations and Their Relations to the Biotic Integrity of Wadeable Streams in Wisconsin: U.S. Geological Survey Professional Paper 1722, 156 p.
- Certification letter from Wisconsin Attorney General's office, dated December 23, 2010.

D. Other supporting documents provided by Wisconsin:

- Email transmission from Jim Baumann (WDNR) to Brian Thompson (U.S. EPA) on December 16, 2010 regarding derivation of Wisconsin lakes phosphorus criterion

E. Description of Action:

WDNR has adopted, under NR 102.06, statewide phosphorus water quality criteria for flowing waters (rivers and streams) and lakes and reservoirs, including criteria for the portion of the Great Lakes in Wisconsin. The rivers and streams criteria submitted by Wisconsin apply to all flowing waters except for ephemeral streams or streams identified in ch. NR 104 as limited aquatic life waters. The lakes and reservoirs criteria apply to all lakes and reservoirs except for marsh lakes and other wetlands. The Great Lakes criteria consist of criteria for the open waters

of Lake Superior, the open waters of Lake Michigan, the near shore waters of Lake Michigan, and Green Bay in Lake Michigan, which is covered by a separate narrative criterion at NR 102.06(5)(c).

WDNR also adopted a companion NPDES rule at s. NR 217, "Effluent Standards and Limitations for Phosphorus" (NR 217.01-19). NR 217.04 provides for determining when a water quality based effluent limitation (WQBEL) is needed in a WPDES permit and how such a WQBEL is to be calculated. The NPDES rule also establishes compliance schedule provisions, a watershed adaptive management option where it can be documented that phosphorus concentrations are improving in the receiving water, and variance provisions for phosphorus for stabilization pond and lagoon systems. Regarding the NPDES rule, only the compliance schedule authorizing provision at NR 217.17 and the variance provision at NR 217.19 fall under the purview of CWA section 303(c) and this water quality standards review. EPA intends to review NR 217 as a possible revision to Wisconsin's approved NPDES program under 40 CFR 123.62. EPA will contact WDNR when EPA completes that review.

F. Basis of Action:

- Wisconsin Statutes at 281.15
- Clean Water Act, Sections 101(a)(2), 303(c), and 118
- Federal regulations at 40 CFR 131 and 132

II. Areas Affected and Environmental Impacts

A. Area Affected:

The proposed rule applies statewide as identified in Section I.E. above.

B. Environmental Impacts:

1. Aquatic Life:

The rivers and streams criteria were developed to satisfy the requirements of section 303(c)(2)(A) of the CWA and specify water quality criteria for phosphorus that are intended to prevent in-stream algae and other plant growth attributable to phosphorus that could become detrimental to fish and aquatic life and impact designated uses, based on the evaluation of multiple measures of fish and invertebrate community health. The technical justification of the rivers and streams criteria is found in WDNR's technical support document (WDNR 2010), Robertson et al. 2006, and Robertson et al. 2008, all of which are provided in the submission package. Based on evaluation of these materials as described in greater detail below, EPA believes that the criteria are protective of aquatic life.

The lakes and reservoirs criteria were developed to satisfy the requirements of section 303(c)(2)(A) of the CWA and specify water quality criteria for phosphorus that are intended to protect critical environmental needs of aquatic life in lake systems from adverse effects attributable to phosphorus. Since different types of lakes and reservoirs respond to phosphorus

enrichment in different ways based on differences in the biological and physical nature of the lakes, the specific relationships that are the basis of the criteria differ with lake type. Depending on lake type, the criteria prevent disruption of the plant community structure, maintain adequate dissolved oxygen to support aquatic animals, and/or maintain the expected/desired lake fish community. The technical justification of the reservoirs and lakes criteria is found in WDNR's technical support document (WDNR 2010), which is provided in the submission package. Based on evaluation of this document, EPA believes that the criteria are protective of aquatic life.

2. Human Health:

The lakes criteria are also intended to prevent adverse impacts on recreation due to nuisance blooms of algae. These criteria were designed to limit nuisance algal bloom conditions to infrequent occurrence. The technical justification of the reservoirs and lakes criteria is found in WDNR's technical support document (WDNE 2010), which is provided in the submission package. Based on evaluation of this document, EPA believes that the criteria are protective of recreational uses.

III. CWA Sections 101(a)(2)/303(c)(2)/118(c)(2)/40 CFR 131 and 132 Review

A. EPA's authority under section 303(c)(2) of the CWA:

Water quality standards requirements of CWA sections 101(a)(2) and 303(c)(2) are implemented through federal regulations contained in 40 CFR 131; water quality standards requirements of CWA section 118, specific to waters of the Great Lakes System, are implemented through federal regulations contained in 40 CFR 132. CWA sections 303(c)(2) and (c)(3) and implementing regulations at 40 CFR 131.21 require EPA to review and approve or disapprove state-adopted water quality standards. In making this determination, EPA must consider the following requirements of 40 CFR 131.5:

- whether state-adopted uses are consistent with CWA requirements;
- whether the state has adopted criteria protective of the designated uses;
- whether the state has followed legal procedures for revising its standards;
- whether state standards are based on appropriate technical and scientific data and analyses; and
- whether the state's submission includes certain basic elements as specified in 40 CFR 131.6.

Section 101(a)(2) of the CWA specifies that designated uses "provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the water." Section 303(c)(2) of the CWA requires that standards shall protect the public health and shall take into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational, agricultural, industrial, and navigational purposes

EPA is required to review and either approve or disapprove new and revised water quality standards submitted by states and tribes. More specifically, possible EPA actions include:

- **Approval** (where EPA has concluded that approval of certain revisions will have no effect on listed species, or is otherwise not subject to ESA consultation),
- **Approval subject to ESA consultation** (where EPA has concluded that certain revisions may affect listed species (including beneficial effects)),
- **Disapproval** (where EPA has concluded that certain revisions do not meet the requirements of the CWA or federal regulations and guidance), and
- **No EPA action** (where EPA has concluded that certain revisions are not revisions to the State's or Tribe's WQS and therefore do not need to be reviewed under Section 303(c) of the CWA.

Consistent with federal regulations at 40 CFR 131.21, new or revised water quality standards do not become effective for CWA purposes until they are approved by EPA.

B. EPA's Review of Wisconsin's Proposed Rules:

WDNR provided the proposed phosphorus criteria rules to EPA on March 17, 2010. EPA submitted comments to WDNR in a letter on April 30, 2010, addressing several aspects of the proposed rules. Those comments are summarized below:

1) Wisconsin should adopt a statement that nutrient water quality criteria should provide for the attainment and maintenance of the water quality standards of downstream waters.
2) Without supporting data and analysis, EPA cannot approve the portion of the rule automatically authorizing a variance for all lagoon systems serving populations under 2,000.
3) Wisconsin should continue its work in developing the technical support document of the scientific basis for the criteria.

In response, WDNR made several revisions to the final rule and augmented its technical support document for the criteria derivation. In NR 217.13(3), WDNR added language indicating that 1) "For discharges of phosphorus directly to inland lakes, reservoirs and other receiving waters which do not exhibit a unidirectional flow at the point of discharge, the department shall set the effluent limit equal to the criterion for the receiving water or the downstream water," and 2) WDNR review of variance applications will include evaluation of financial affordability of each permittee that applies for a variance. In addition, Wisconsin's revised technical support document provides additional technical information on how the rivers and streams and the lakes and reservoirs criteria were derived.

The record shows that the rule revisions and additional information provided by WDNR adequately address EPA's comments on the proposed rule. WDNR's added language in the final rule specifying that it will set the effluent limits equal to the criteria for direct dischargers into lakes will help protect downstream waters within the state. WDNR's added language that review of variance applications will include evaluation of financial affordability of each permittee that applies for a variance addresses the intent of the Federal regulation at 40 CFR 131.13 regarding policies that may affect water quality standards. The revised technical support document

provides the information needed to allow EPA to evaluate the scientific defensibility of the criteria for rivers and streams and the lakes and reservoirs.

C. Public Comments Raised on WDNR's proposed phosphorus criteria rule:

WDNR published proposed rules and held public hearing on the phosphorus criteria. The public comments to the proposed rules and WDNR's response to the public comments can be accessed at: https://health.wisconsin.gov/admrules/public/Rmo?nRmoId=4783 under "Report to the Legislature."

EPA considered the information in WDNR's document cited above, along with the phosphorus rules adopted by Wisconsin, and the technical support materials provided by Wisconsin and cited in I.C. and D. above. For the reasons provided in Section III. D. 2. below, EPA concludes that the phosphorus water quality standards at NR 102.06, the compliance schedule authorizing provision at NR 217.17, and the variance rule at NR 217.19 are consistent with the requirements of section 303(c) of the CWA and federal regulations at 40 CFR 131.

D. EPA's Review of Wisconsin's Final Rules:

1. Review of Submittal for Completeness:

Regulatory Requirement:	Wisconsin's Rule Submittal:
Use designations must be consistent with the provisions of section 101(a)(2) and 303(c)(2) of the Act **(40 CFR 131.6(a))**	The proposed nutrient criteria do not affect the designated uses of the rivers and streams or the lakes and reservoirs in Wisconsin.
Methods used and analyses conducted to support WQS revisions must be included in the submission **(40 CFR 131.6(b))**	Wisconsin provided the methods and analyses in support of the proposed nutrient water quality criteria. These methods and analyses are included under I.C., above, "Documents included in the submittal" and I.D., "Other supporting documents."
Water quality criteria must be sufficient to protect the designated uses of Wisconsin surface waters **(40 CFR 131.6(c))**	Wisconsin is adopting nutrient water quality criteria in order to protect the designated uses in Wisconsin. Based on "EPA's Review of Submittal for Scientific Supportability" (Section III. C.2., below), EPA is determining that the proposed criteria are protective of Wisconsin's designated uses.
Antidegradation policy must be consistent with §131.12 **(40 CFR 131.6(d))**	The proposed nutrient criteria do not affect Wisconsin's antidegradation policy or implementation procedures.
Certification by the State Attorney General or other appropriate legal authority within the State that the WQS were duly adopted pursuant to State law must be included in the submission. **(40 CFR 131.6(e))**	Legal certification was provided by letter from the Wisconsin Deputy Attorney General.
General information must be included which aids the Agency in determining the adequacy of the scientific basis of the standards which do not include uses specified in section 101(a)(2) of the Act as well as information on general policies applicable to State standards which their application and implementation. **(40 CFR 131.6(f))**	Wisconsin provided the necessary information addressing the scientific basis supporting the proposed nutrient water quality criteria. The list of this information is under Section I.B. Submittal History, above.

2. EPA's Review of Submittal for Scientific Defensibility and Consistency with CWA and Federal Regulations:

The documents provided by WDNR and cited in Section I.C. and D. above describe the scientific method and the statistical analysis that WDNR used in deriving the criteria. EPA's review and conclusions are presented below by water body type.

Rivers and Streams

Wisconsin's rivers and streams phosphorus criteria are based upon observed correlations between increasing concentrations of phosphorus and changes indicative of disturbance in commonly used and widely accepted measures of plant, fish, and macroinvertebrate community health. These measures include a diatom nutrient index, a diatom siltation index, a diatom biotic index, the Hilsenhoff Biotic Index, percentage of EPT (the aquatic insect orders *Ephemeroptera*, *Plecoptera* and *Trichoptera*) individuals, the percentage of EPT taxa, a fish index of biotic integrity, the percentage of carnivorous fish present in a sample at a site, and the percentage of intolerant fish present in a sample at a site. Such aquatic life plant and animal assemblage measures are among those that are commonly used by states, tribes, and EPA to assess ecosystem health and determine whether or not aquatic life uses of rivers and streams are impaired. (EPA 2002, p. 3-1 to 3-246).

These metrics (i.e., those listed in the preceding paragraph) were selected from among all biological indicators for which Wisconsin collects data because they are ecologically significant (i.e., the metric is a strong indicator of community health) and because of the statistical significance of their correlation to phosphorus concentrations. Data were collected for the indicators across the entire spectrum of phosphorus conditions in the State of Wisconsin to ensure that as many aspects of biological response across the gradient of phosphorus concentrations as possible were considered. Subsequently, a phosphorus threshold or concentration at which significant biological effects were observed was calculated for each metric.

WDNR used change point analysis to identify points along a gradient of phosphorus concentrations where a response in the biological indicator occurred. Multiple change points were determined and evaluated based on expert knowledge of the expected biological condition of Wisconsin rivers and streams and the ways in which Wisconsin rivers and streams respond to increasing concentrations of phosphorus. Individual change points were aggregated to yield a composite estimate of the phosphorus concentration expected to protect aquatic life uses of Wisconsin streams, in a process that is analogous to the way biological assessment data from multiple biological indicators are routinely aggregated by states into a single determination of aquatic life use attainment for purposes of identifying attaining and impaired waters under section 303(d) of the CWA. Wisconsin used the median of the selected phosphorus thresholds in establishing the criteria. While the evaluation of any one of these indicators by itself may not fully address aquatic life community health nor provide absolute certainty in an observed threshold value, the similarity in the threshold values of the selected biological metrics provides greater confidence that the median of the thresholds is an accurate indicator of phosphorus concentrations necessary to protect aquatic life uses of Wisconsin's surface waters. Using a

median of thresholds provides the most accurate estimate of where effects are occurring because of the uncertainty around each individual metric.

Subsequent to Wisconsin's completion of adoption of its phosphorus criteria for rivers and streams, EPA published technical guidance to states and tribes on how nutrient criteria can be derived from biological response data (EPA 2010). This guidance was developed by EPA to address scientific questions about the appropriate mechanism for deriving nutrient criteria based on empirical observations of biological responses along a gradient of nutrient conditions. In addition, this 2010 EPA guidance was reviewed and accepted by the EPA Science Advisory Board's Ecological Processes and Effects Committee. The guidance recommends a four-step process described in the document as follows:

- In the first step, conceptual models representing known relationships between nitrogen (N) and phosphorus (P) concentrations, biological responses, and attainment of designated uses are developed for the study area. To facilitate developing these models, the guidance document provides detailed conceptual models for lakes and streams that can be modified according to the characteristics of the local study area.

- In the second step, data are assembled and initial exploratory analyses are performed. Variables are selected during this step that represent different concepts shown on the conceptual model, including variables that represent N and P concentrations, variables that represent responses that can be directly linked with designated uses, and variables that can potentially confound estimates of stressor-response relationships. After selecting variables and assembling data, these data are explored to provide insights into how different variables are distributed and how groups of variables covary with one another. These exploratory analyses inform subsequent development of formal statistical models.

- In the third step, stressor-response relationships are estimated between N and P concentrations and the selected response variables, and criteria are derived from these relationships. The guidance document presents an analysis approach that emphasizes *classification*, to maximize the accuracy and precision of estimated stressor-response relationships, and *simple linear regression*, to provide stressor-response relationships that can be most easily interpreted for criteria derivation. Methods for interpreting simple linear regression models in terms of predicting the probability of different outcomes are discussed in the context of criteria derivation.

- In the final step, the accuracy and precision of estimated stressor-response relationships are evaluated and the analyses documented. The accuracy of estimated relationships is evaluated with regard to the possible influence of known confounding variables as identified by the conceptual model or by exploratory data analysis. The required precision of estimated relationships depends strongly on the relevant management decisions, and so, evaluating precision is discussed in this context.

Since Wisconsin completed adoption of its rules prior to publication of the EPA guidance, Wisconsin was not able to employ directly the EPA-recommended procedures in developing its phosphorus criteria. However, despite being arrived at independently, the criteria development

process followed by WDNR is largely consistent with the process recommended by EPA and therefore scientifically-defensible, as discussed below.

Step 1. A conceptual model is developed.

Pages three through four of WDNR's document, "Wisconsin Phosphorus Water Quality Standards Criteria: Technical Support Document," (the phosphorus TSD) include a verbal conceptual model of the way phosphorus enrichment affects rivers and streams in Wisconsin, consistent with the recommendations in EPA's 2010 guidance.

Step 2. Data are assembled and initial exploratory analyses are conducted.

As documented in the phosphorus TSD (pages 6 – 15), WDNR began doing preliminary work investigating the relationship between phosphorus and condition of rivers and streams in the early 1980s. Beginning in 2001, WDNR began a partnership with USGS intended to:

1. Describe how nutrient – both phosphorus and nitrogen – concentrations and the biotic community vary throughout Wisconsin.
2. Determine which environmental characteristics are most strongly related to the distribution of nutrient concentrations.
3. Determine reference water quality and biotic conditions for different geographic areas across the state.
4. Determine how the stream biotic communities respond to changes in nutrient concentrations.
5. Determine the best regionalization scheme to describe the patterns in reference conditions and responses in water quality and in the biotic community.
6. Develop new indices or algorithms to estimate nutrient concentrations in streams from a combination of biotic indices.

As stated in the phosphorus TSD at pages 6-7, the results of these studies are reported in two documents jointly prepared by WDNR research staff and USGS staff. The first report, "Nutrient Concentrations and Their Relations to the Biotic Integrity of Wadeable Streams in Wisconsin", was based on analyzing data from 240 smaller and larger streams collected in 2001, 2002 or 2003.[1] The second report, "Nutrient Concentrations and Their Relations to the Biotic Integrity of Nonwadeable Rivers in Wisconsin", was based on analyzing data from 42 rivers collected in 2003.[2] The studies collected fish, aquatic insect, and water quality data from 282 study sites.

Step 3. Stressor-response relationships are estimated between N and P concentrations and the selected response variables, and criteria are derived from these relationships.

[1] Robertson, D. M., Graczyk, D. J., Garrison, P. J., Wang, L., LaLiberte, G., and Bannerman, R., "Nutrient Concentrations and Their Relations to the Biotic Integrity of Wadeable Streams in Wisconsin", USGS Professional Paper 1722, 2006.

[2] Robertson, D. M., Weigel, B. M., Graczyk, D. J., "Nutrient Concentrations and Their Relations to the Biotic Integrity of Nonwadeable Rivers in Wisconsin", USGS Professional Paper 1754, 2008.

Wisconsin is only proposing criteria for phosphorus at this time. WDNR used the data and analyses generated through its collaboration with USGS to select response variables and begin the process of deriving criteria. This is described in detail on pages 8 – 17 of the phosphorus TSD.

Step 4. The accuracy and precision of estimated stressor-response relationships are evaluated and the analyses documented.

Pages 17 – 21 of the phosphorus TSD describe the additional analyses conducted by WDNR to validate the relationships identified between phosphorus and measures of biological community health. Of particular note is the work conducted by WDNR in the early part of 2010 in direct response to EPA's Science Advisory Board guidance on the use of stressor-response relationships to derive nutrient criteria. WDNR's review of the earlier work in light of the new Science Advisory Board guidance validated the relationships between phosphorus levels and biological health that are the basis for the criteria adopted by WDNR.

In addition, EPA notes that other information and data corroborate WDNR's proposed phosphorus criteria for rivers and streams. Wisconsin's stressor-response analysis across multiple biological metrics is supported by EPA's ecoregional criteria documents (EPA 2000, 2001) in combination with USGS's evaluation (Robertson et al. 2006) of whether there is significant variation across Wisconsin in the biological thresholds that were used to set the criteria. EPA's criteria documents suggest criteria of 70 and 80 µg/l total phosphorus in the southern portion of Wisconsin (Ecoregions 52 and 53). These values are intended to estimate minimally impacted nutrient concentrations, but are not based on biological effects and therefore are not necessarily indicators of the levels that have to be met to assure protection of the designated uses for aquatic life. Wisconsin's criteria for wadeable streams (75 µg/l) and non-wadeable streams (100 µg/l) are fairly close to these values for southern Wisconsin. This suggests that the stressor-response-based criteria proposed by Wisconsin are based on biological responses that occur at relatively low levels of enrichment and relatively limited levels of disturbance. The USGS technical report (Robertson et al. 2006, p 1-2) indicates that although ambient phosphorus concentrations were lower or higher in some ecoregions, the biological indices used by Wisconsin to set the phosphorus criteria responded similarly to changes in phosphorus concentrations across the state. Robertson et al. concluded that although ambient concentrations may be lower in certain regions, the biological thresholds upon which the criteria are established do not vary significantly across the state (Robertson et al. 2006, p. 40-76). Although EPA criteria documents suggest a criterion below 30 µg/l for the northern portion of Wisconsin, EPA's criteria are again based upon an approximation of minimally impacted conditions. Given the relatively undisturbed conditions in northern Wisconsin, it is reasonable to assume that there will be more streams with lower phosphorus concentrations, resulting in a lower criterion based on minimally impacted conditions. The USGS work on similarities in biological responses to phosphorus enrichment across Wisconsin supports the conclusion that higher concentrations can occur in the northern portion and continue to protect aquatic life uses.

Conclusion: EPA finds that WDNR's approach for rivers and streams, summarized in the preceding paragraphs, is scientifically defensible and the criteria for phosphorus for rivers and streams are sufficient to protect uses of the rivers and streams covered by the criteria, consistent

with applicable requirements of the CWA and EPA's implementing regulations and, thus, approvable pursuant to section 303(c)(3) of the CWA.

Reservoirs and Lakes

The reservoirs and lakes criteria protect aquatic life in and recreational uses of reservoirs and lakes, based on the type of lake. Wisconsin's methodology presented in the TSD identifies objectives and ecological thresholds to protect these critical needs. These objectives include minimizing the frequency of nuisance algal conditions, minimizing shifts in aquatic plant communities, and sustaining fish communities.

Deep, drainage lakes and deep reservoirs (30 µg/L)

WDNR considered recreational and aquatic life uses in deriving criteria for deep, drainage lakes. Recreation uses are protected by limiting the frequency of nuisance algal blooms during the recreation season. Aquatic life uses are protected by maintaining the expected fish community. WDNR used data and analyses from the Minnesota Pollution Control Agency (MPCA 2005) that Minnesota used to support the lakes nutrient criteria which Minnesota adopted and EPA approved in 2008. Using data from Minnesota lakes similar to Wisconsin's deep, drainage lakes, WDNR determined the phosphorus concentration (30 µg/L) that would result in infrequent (5 percent of the time or less) nuisance algal bloom occurrence. WDNR considered additional data and analyses by MPCA for similar lakes in Minnesota in determining that a total phosphorus criterion of 30 µg/l would also be sufficient to protect fish communities in deep drainage lakes.

EPA previously approved Minnesota's lake phosphorus criteria in 2008 (EPA 2008). Deep drainage lakes in Minnesota and Wisconsin occur in the same ecoregions that span both states and support similar biological communities. EPA considers the conditions in Wisconsin and Minnesota are similar enough for Wisconsin to rely on Minnesota data and analyses. Wisconsin used Minnesota data on the frequency of algal blooms based on in-lake phosphorus concentration to develop its phosphorus criterion for its deep lakes. EPA agrees that setting a phosphorus criterion to limit the frequency of algal blooms is a reasonable approach to support recreational uses because Wisconsin is protecting aesthetics. The available data indicate that a phosphorus criterion of 30 µg/L will provide the specified level of protection of recreation from aesthetic impacts due to algae blooms. In addition, the available data indicate that a total phosphorus criterion of 30 µg/L will protect fish communities in deep drainage lakes in Wisconsin (WDNR 2010, p. 26). Therefore, EPA finds Wisconsin's approach to protecting recreation in deep drainage lakes by limiting nuisance algal bloom occurrence to less than 5 percent of the time consistent with section 303(c)(2) of the CWA and Federal regulations at 40 CFR 131.11 as well as with EPA's approval of phosphorus criteria for similar lakes in Minnesota (EPA 2008).

Conclusion: The criteria for phosphorus proposed by Wisconsin are scientifically defensible and consistent with applicable requirements of the CWA and EPA's implementing regulations and, thus, approvable pursuant to section 303(c)(3) of the CWA.

Deep, seepage lakes (20 µg/l)

For lakes in the class of deep seepage lakes, WDNR determined that protection of the aquatic community and aquatic life uses would require more stringent phosphorus criteria than the 30 µg/L criterion for the deep, drainage lakes. WDNR based this determination on the fact that retention time is longer in deep seepage lakes so that nutrients are available for a longer period of time and that deep seepage lakes are difficult to restore. To develop criteria for this class of lakes, WDNR used sediment core data to infer minimally impacted conditions at 15 µg/L based on the mean of these cores plus one standard deviation (WDNR 2010, p 29). WDNR also assessed the relationship between phosphorus and dissolved oxygen in the water column and determined that a criterion of 20 µg/L would provide sufficient dissolved oxygen throughout the water column to support the expected biological community characterized by dissolved oxygen-sensitive cool water fish species. EPA agrees with WDNR's rationale that a criterion lower than 30 µg/l is needed to protect aquatic life.

Conclusion: The criteria for phosphorus proposed by Wisconsin are scientifically defensible and consistent with applicable requirements of the CWA and EPA's implementing regulations and, thus, approvable pursuant to section 303(c)(3) of the CWA.

Two-story lakes (15 µg/L)

As with the preceding lake class, WDNR determined that protection of aquatic life would require more stringent phosphorus criteria than the 30 µg/l criterion for deep, drainage lakes. This determination was based on the need to protect cold water species in the hypolimnion (WDNR 2010, p 28). WDNR used a reference lake approach for two-story lakes with the objective of maintaining water quality at levels consistent with conditions of minimum human impact in order to protect dissolved oxygen-sensitive coldwater fish species expected to be present in the hypolimnion. WDNR derived the phosphorus criterion through the analysis of sediment cores, setting the criterion equal to 15 µg/L, which is the mean of these cores plus one standard deviation. EPA reviewed this procedure for quantifying the minimally impacted condition and concludes that it is a defensible approach to setting a criterion because this is consistent with EPA's ecoregional criteria document (EPA 2001). EPA notes that figure three on page 29 of the phosphorus TSD presents data from Minnesota that suggests that lake trout are not found in two story lakes at phosphorus concentrations greater than 15 µg/L. Additional information provided by WDNR (Baumann, 2010) indicates that figure three is based on a very small set of data for two story lakes in Minnesota. Furthermore, Wisconsin data for two story lakes show that lake trout do occur in two story lakes with phosphorus concentrations greater than 15 µg/L. Therefore, WDNR's 15 µg/l criterion is protective of the aquatic life use in two story lakes.

Conclusion: The criteria for phosphorus proposed by Wisconsin are scientifically defensible and consistent with applicable requirements of the CWA and EPA's implementing regulations and, thus, approvable pursuant to section 303(c)(3) of the CWA.

Shallow lakes (40 µg/L)

Lakes in this class are inherently more productive because they are shallower than the other lake classes. WDNR considered recreational and aquatic life uses in deriving criteria for shallow lakes. In addressing recreational uses, WDNR's objective was to ensure adequate water quality to limit nuisance algal bloom conditions to infrequent occurrence. WDNR's objective for aquatic life uses in shallow lakes was to maintain the macrophyte-dominated aquatic plant community typical of minimally-disturbed lakes of this class. WDNR relied on data and analyses generated by MPCA for similar lakes in Minnesota (MPCA 2005) to determine a phosphorus concentration that would minimize the frequency of nuisance algal blooms and determined that a concentration of 40 µg/l would be sufficient to limit nuisance algal bloom frequency to 10% or less of the recreation season. WDNR used other data and analyses by MPCA for Minnesota to establish the phosphorus concentration associated with a shift from macrophyte dominated to algal dominated during the summer for shallow lakes. The Minnesota data indicate that the start of this shift is apparent at about 40 µg/l total phosphorus (MPCA 2005).

EPA previously approved Minnesota's lake criteria in 2008 (EPA 2008). Shallow lakes in Minnesota and Wisconsin occur in the same ecoregions that span both states and are characterized by similar biological communities and responses to enrichment. In EPA's assessment, the ecoregional conditions in Wisconsin and Minnesota are similar enough to allow Wisconsin to rely on Minnesota data and analyses. Based on similarities between Wisconsin and Minnesota's shallow lakes, EPA considers it reasonable for WDNR to follow Minnesota's approach in limiting nuisance algal blooms to a certain percentage of the time to protect aesthetics. The available data indicate that a phosphorus criterion of 40 µg/l will provide the specified level of protection of recreation from aesthetic impacts due to algae blooms. Similarly, the available data indicate that a total phosphorus criterion of 40 µg/l will prevent transformation of shallow lakes from macrophyte dominated plant communities to suspended algae dominated communities that is characteristic of an enriched condition for shallow lakes in Wisconsin (WDNR 2010, p 30-31). Therefore, EPA considers the Wisconsin approach to protect recreation in shallow lakes by limiting nuisance algal bloom occurrence to less than 10 percent of the time to be consistent with section 303(c)(2) of the CWA and Federal regulations at 40 CFR 131.11 as well as with EPA's approval of phosphorus criteria for similar lakes in Minnesota (EPA 2008).

Conclusion: The criteria for phosphorus proposed by Wisconsin are scientifically defensible and consistent with applicable requirements of the CWA and EPA's implementing regulations and, thus, approvable pursuant to section 303(c)(3) of the CWA.

Great Lakes

WDNR used the guidelines from the International Joint Commission for the Great Lakes in setting the criteria of 7 µg/l for Lake Michigan and 5 µg/l for Lake Superior (Phosphorus Management Strategies Task Force 1980). According to the International Joint Commission, the 7 µg/l value for Lake Michigan is based on maintaining the lake at the breakpoint between an oligotrophic and a mesotrophic body of water. The International Joint Commission's

recommendations are the best currently available scientific assessment of the phosphorus levels necessary to protect Lakes Michigan and Superior.

When developing water quality criteria for the Great lakes, under 40 CFR 132.4(e)(2) and (g), for pollutants listed in Table 5 of Part 132, which includes phosphorus, Great Lakes states may apply any methodologies and procedures acceptable under 40 CFR part 131 and consistent with all applicable Federal, state and tribal laws.

Conclusion: The criteria for phosphorus proposed by Wisconsin are scientifically defensible and consistent with applicable requirements of the CWA and EPA's implementing regulations and, thus, approvable pursuant to section 303(c)(3) of the CWA.

Green Bay

WDNR adopted narrative nutrient criteria for Green Bay to ensure that water clarity and other phosphorus-related conditions are supportive of a diverse biological community, including submersed aquatic vegetation in shallow water areas. The narrative criterion is: "For the portion of Green Bay from the mouth of the Fox River to a line from Long Tail Point to Point au Sable, the water clarity and other phosphorus-related conditions that are suitable for support of a diverse biological community, including a robust and sustainable area of submersed aquatic vegetation in shallow water areas."

In its Technical Support Document, WDNR identified 60 µg/l total phosphorus and 15 mg/l total suspended solids as numeric translators for this narrative criterion. WDNR then calculates concentrations of 60 µg/l total phosphorus and 15 mg/l total suspended solids as numeric translators of the narrative criterion to meet a Secchi disk depth of 1.2 meters. The numeric translators are not part of the Wisconsin rule, so the state can revise these targets later if it finds that they are not sufficiently protective of aquatic life. EPA finds that this narrative WQS for lower Green Bay is consistent with the Section 101 of CWA goal of protecting aquatic life.

Conclusion: The narrative criterion for Green Bay adopted by Wisconsin is scientifically defensible and consistent with applicable requirements of the CWA and EPA's implementing regulations and, thus, approvable pursuant to section 303(c)(3) of the CWA.

Other Non-criteria WQS Components of Wisconsin's Submittal:

NR 217.17 Compliance Schedule Authorizing Provision

In *In re Star-Kist Caribe, Inc.*, 3 E.A.D. 172, 175, 177 (1990), the Administrator determined that "the only instance in which [an NPDES] permit may lawfully authorize a permittee to delay compliance after July 1, 1977, pursuant to a schedule of compliance, is when the water quality standard itself (or the State's implementing regulations) can be fairly construed as authorizing a schedule of compliance." With that in mind, EPA has determined that NR 217.17 (i.e., "... the department may provide a schedule of compliance for a water quality-based phosphorus effluent limitation ...") is such a compliance schedule authorizing provision and reviewed it pursuant to CWA 303(c). As a result of its review, EPA has determined that NR 217.17 is approvable as a

compliance schedule authorizing provision consistent with *In re Star-Kist Caribe, Inc., supra,* and EPA's May 10, 2007 memorandum "Compliance Schedules for Water Quality-Based Effluent Limitations in NPDES Permits."

Conclusion: The compliance schedule authorizing provision at NR 217.17 (i.e., "... the department may provide a schedule of compliance for a water quality-based phosphorus effluent limitation ...") is approvable pursuant to section 303(c)(3) of the CWA. In approving NR 217.17 as a compliance schedule authorizing provision pursuant to section 303(c), EPA is not making a determination as to its adequacy pursuant to CWA section 402(b) or 40 CFR 123.61 or 123.62. In addition, this approval is not a determination regarding the adequacy of the state's program or the state's legal authority to implement and administer the NPDES program in accordance with the requirements in CWA section 402(c)(2) or 40 CFR section 123.25.

NR 217.19 Variance Procedures for Permitted Lagoon and Pond Wastewater Treatment Systems

Consistent with Federal regulations at 40 CFR 131.13, variance general policies are subject to review and approval by EPA under section 303(c) of the CWA. EPA has reviewed NR 217.19 and determined that these general variance policies are acceptable general processes for the state to consider variances and are consistent with applicable Federal regulations, including 131.10(g) and 131.13, and EPA General Counsel Opinion No. 58 (1977) on variances from water quality standards.

NR 217.19(4)(a)(1) provides that each permittee granted a variance will receive an initial limit based on the phosphorus level currently achievable by the permittee and that this limit will be equal to the upper 99th percentile of representative daily discharge concentrations expressed as a daily maximum limit. This provision is consistent with the procedure WDNR uses generally to calculate limits based on the level currently achievable, including mercury variances under NR 106.145(5), which was approved by EPA on August 3, 2007. It is also consistent with Procedure 2, Section F.1 of 40 CFR Part 132. The purpose of this Wisconsin provision is to require a limit that will ensure the water quality conditions currently attained continue to be maintained during the term of the variance and that the variance does not allow those conditions at the site to deteriorate. EPA finds that limiting the effluent phosphorus concentration in this way is reasonable and defensible, since the controls necessary to attain this limit will also ensure that the discharge continues to be operated to produce an effluent quality at least as good as the level currently achievable. Although Wisconsin is not required to follow the procedures in the Great Lakes Water Quality Guidance at 40 CFR 132 (the Guidance) for phosphorus, those procedures provide an indication of EPA's expectations regarding variance limits based on the level currently achievable. The Guidance requires that such limits be based on facility-specific data and reflect the level currently achievable by the facility seeking a variance. WDNR's procedure for calculating limits satisfies both of these requirements, and, as noted above, was approved by EPA for mercury, a pollutant which is covered by the Guidance.

In addition, NR217.19 includes a note that given currently available technology for stabilization ponds and lagoons, "it is unlikely that a phosphorus water quality based effluent limit less than 1 mg/L can be consistently met." The note goes on to say that, "[t]o meet phosphorus water quality based effluent limits of less than 1 mg/L, it will be necessary for owners of the systems to

construct new waste water treatment plants which could result in substantial and widespread adverse social and economic impacts." Given the language in this note that constructing new water treatment plans "could result" in substantial and widespread adverse social and economic impacts and given Wisconsin's requirement that each permittee submit a financial affordability analysis, EPA finds that the note does not somehow qualify as a categorical variance. Section 217.19 also includes a note indicating each individual variance from water quality standards granted under NR 217.19 will be submitted to EPA for review and approval. Each individual variance is a water quality standards revision itself and therefore, this provision is also consistent with EPA's regulations on revisions to water quality standards. EPA's review and approval on the individual variance will be based on whether such a variance is consistent with the CWA and EPA's implementing regulations, not on consistency with this procedure.

Conclusion: The variance procedures at NR 217.19 are consistent with applicable requirements of the CWA and EPA's implementing regulations and, thus, approval be pursuant to section 303(c)(3) of the CWA.

3. EPA action on the final phosphorus criteria and procedures submitted by WDNR

The information provided by WDNR meets the substantive requirements of 40 CFR 131.6 for a WQS submittal. The technical information provided by WDNR, listed under Section I.C., "Documents included in the submittal," and Section I.D., "Other Supporting Documents," demonstrate that Wisconsin's approach is reasonable and scientifically supportable and that Wisconsin's phosphorus criteria will provide for the protection of the aquatic life and recreation in Wisconsin's lakes and reservoirs and its streams and rivers.

EPA Action: Approve NR 102.06, Phosphorus Water Quality Standards, subject to consultation under section 7 of the Endangered Species Act.

Approve the following text from NR 217.17(1)(a) as a compliance schedule authorizing provision: "... the department may provide a schedule of compliance for a water quality-based phosphorus effluent limitation ..."

Approve NR 217.19, Variances for Stabilization Ponds and Lagoon Systems. Individual variances still need to be submitted to EPA for review and approval or disapproval.

IV. Endangered Species Act (ESA) Requirements

Consistent with section 7 of ESA and federal regulations at 50 CFR Part 402, EPA is required to consult with U.S. Fish and Wildlife Service (USFWS) on any action taken by EPA that may affect federally-listed threatened and endangered species or their designated critical habitat. Actions are considered to have the potential to affect a listed species if the species or its critical habitat is present in the action area. At the time of reviewing Wisconsin's submission, EPA had initiated but not concluded consultation with the USFWS regarding concurrence on whether EPA's approval action was likely to adversely affect any federally-listed species in Wisconsin.

EPA consulted the USFWS website (www.fws.gov/midwest/Endangered/section7/sppranges/wisc-cty.html) on December 6, 2010, to determine if listed species were present in Wisconsin and to initiate consultation. The website identified the following federally-listed species in Wisconsin.

Seven (7) federally-listed plant species (Dwarf lake iris, Eastern prairie fringed orchid, Fassett's locoweed, Mead's milkweed, Northern wild monkshood, Pitcher's thistle, Prairie bush-clover) occupy upland habitats or other habitats that are not significantly affected by nutrient concentrations in streams or lakes in Wisconsin. Consequently these species are not aquatic dependent. EPA's action will not affect these species and so we did not include them in the biological evaluation.

Three (3) of the federally-listed mammal and bird species (Canada lynx, Gray wolf, Kirtland's warbler) have diets that are not significantly dependent on aquatic or aquatic-dependent species and are terrestrial. EPA determined that these species are not aquatic dependent and EPA's action will not have any effect on these species and we did not include them in the biological evaluation. One (1) of the bird species (Whooping crane) is listed based on an experimental population. The crane will have very limited exposure to water from the aquatic ecosystem due to whooping cranes' omnivorous diet. EPA's action will have no significant effect on this species and we did not include it in the biological evaluation.

Five (5) federally-listed mussels (Higgins eye pearlymussel, Sheepnose, Snuffbox, Spectaclecase, Winged mapleleaf) and two (2) federally-listed aquatic-dependent species (Piping plover and Eastern Massasauga) were considered for possible effects from exposure to criteria concentrations of phosphorus.

EPA has completed its analysis of the effects of phosphorus on these species and nearly completed its biological evaluation documenting its conclusions for submittal to the USFWS. EPA's determination is that EPA's approval of Wisconsin's nutrient criteria is not likely to adversely affect these federally-listed species. The primary mode of impact of phosphorus on aquatic and aquatic-dependent species is the potential for reduction of dissolved oxygen. Phosphorus criteria would reduce areas of low dissolved oxygen through the reduction of phosphorus loads and resulting phosphorus concentrations in surface waters. Further, Wisconsin's water quality standards regulation include dissolved oxygen in surface waters of no lower than 5 mg/L at any time. This dissolved oxygen criterion provides a sound measure of whether impacts on aquatic life are likely occurring. The phosphorus criterion serves to provide Wisconsin with an important tool for ensuring attainment of the dissolved oxygen criterion and protection of aquatic life. According to Johnson et al. (2001), 5 mg/L dissolved oxygen is protective of numerous species, including mussel species.

Hence, phosphorus at the concentrations in the rule should not adversely affect the candidate mussels. Therefore, EPA is not expecting its approval of the phosphorus criteria to adversely affect federally-listed mussels in Wisconsin.

V. Documents Considered by EPA

In addition to the CWA federal regulation at 40 CFR Parts 131 and 132, other federal guidance (the primary documents are listed below), and EPA's Water Quality Standards Handbook (EPA 823-B-94-005a, August 1994), the following list includes the primary references considered in this review.

Baumann J. 2010. Additional information on lake phosphorus criteria. Wisconsin Department of Natural Resources.

Johnson PM, AE Liner, SW Golladay WK Michener. 2001. Effects of drought on freshwater mussels and instream habitat in Coastal Plain tributaries of the Flint River, southwest Georgia (July-October, 2000). Final Report given to The Nature Conservancy Apalachicola River and Bay Project. 30 pp.

MPCA. 2005. Minnesota Lake Water Quality Assessment Report: Developing Nutrient Criteria", Third Edition, September, 2005.

Phosphorus Management Strategies Task Force. 1980. *Phosphorus Management for the Great Lakes, Final Report to the International Joint Commission.* Great Lakes Water Quality Board and Great Lakes Science Advisory Board, Windsor, Ontario. 125 pp.

Robertson, D.M., B.M Weigel, and D.J. Graczyk, 2008, Nutrient Concentrations and their relations to the biotic integrity of nonwadeable rivers in Wisconsin: U.S. Geological Survey Professional Paper 1754, 81 p.

Robertson, D.J. Graczyk, P.J. Garrison, L. Wang, G. LaLiberte, and R. Bannerman, 2006, Nutrient Concentrations and Their Relations to the Biotic Integrity of Wadeable Streams in Wisconsin: U.S. Geological Survey Professional Paper 1722, 156 p.

EPA. 1977. Decision of the General Counsel No. 58, In Re Bethlehem Steel Corporation, March 29, 1977.

EPA. 2000. Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion VI. Office of Water. Washington, DC. December 2000. EPA 822-B-00-017.

EPA. 2000. Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion VII. Office of Water. Washington, DC. December 2000. EPA 822-B-00-018.

EPA. 2001. Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion VIII. Office of Water. Washington, DC. December 2001. EPA 822-B-01-015.

EPA. 2002. Summary of Biological Assessment Programs and Biocriteria Development for States, Tribes, Territories, and Interstate Commissions: Streams and Wadeable Rivers. Office of Environmental Information and Office of Water. Washington, DC. December 2002. EPA-822-R-02-048.

EPA. 2008. Letter from U.S. EPA-Region 5 to Michael J. Sandusky approving Minnesota's water quality standards adopted on March 10, 2008. Letter dated May 23, 2010.

EPA. 2010. Using Stressor-response Relationships to Derive Numeric Nutrient Criteria. Office of Water. Washington, DC. November 2010. EPA-820-S-10-001.

USFWS. 2004. "Higgins Eye Pearlymussel (*Lampsilis higginsii*) Recovery Plan: First Revision". Ft. Snelling, Minnesota. 126 pp.

USFWS. 2008a. "Higgins' Eye Pearly Mussel Recovery" U. S. Fish and Wildlife Service, Rock Island, Illinois, Endangered Species website at www.fws.gov/midwest/rockisland/activity/ENDANGRD/higgins.htm. 4/10/2008.

USFWS. 2008b. "Higgins eye (*Lampsilis higginsii*) Essential Habitat Areas, 2008 Review and Addition of New EHAs." USFWS Endangered Species website at www.fws.gov/midwest/endangered/clams/higginseye/hepmeha.html.

USFWS. 2010. "County Distribution of Wisconsin's Federally Threatened, Endangered, Proposed, and Candidate Species." USFWS – Midwest Region's Section 7 Consultation Technical Assistance website at www.fws.gov/midwest/endangered/section7/sppranges/index.html. July 2010.

WDNR. 2010. Technical Support Document for Wisconsin Phosphorus Water Quality Standards.